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Title of the Invention: POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY USING THE SAME

I, Kyoko HIRANO, whose full post office address is IKEUCHI·SATO & PARTNER PATENT ATTORNEYS, 26th Floor, OAP TOWER, 8-30, Tenmabashi 1–Chome, Kita-ku, Osaka-Shi, OSAKA 530-6026, JAPAN

am the translator of the document attached and I state that the following is a true translation to the best of my knowledge and belief of Japanese Patent Application No. 2000-238724 (Date of Application: August 7, 2000).

At Osaka, Japan
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Signature of the translator

Kyoko Hirano

Kyoko HIRANO

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[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Youichirou SUGINO
[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Eiji HAMAMOTO
[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Seiichi KUSUMOTO
[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Hisashi MIHARA
[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Senri YOSHIKAWA
[Inventor]
[Address] c/o Nitto Denko Corporation
1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN
[Name] Kazuki TSUCHIMOTO
[Patent Applicant]
[Identification Number] 000003964
[Name of Company] Nitto Denko Corporation
[Attorney]

[Identification Number] 100095555
[Patent Attorney]
[Name] Hiroyuki IKEUCHI
[Telephone number] 06-6361-9334

[Appointed Attorney]
[Identification Number] 100076576
[Patent Attorney]
[Name] Kimihiro SATO

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[TITLE OF THE INVENTION] POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY USING THE SAME

[CLAIMS]

[Claim 1] A polarizing plate comprising a polarizer, wherein all surfaces and sides of the polarizer are covered with low moisture-permeable layers having moisture permeability of 310 g/m^2·24h or less.

[Claim 2] The polarizing plate according to claim 1, wherein a rate of change in dimension of the polarizer in a uniaxially stretching direction is ±0.1% or less after the polarizer is left at a temperature of 60°C and humidity of 95% for 100 hours.

[Claim 3] The polarizing plate according to claim 1 or 2, wherein the polarizing plate is formed into a size of 90 mm×90 mm and attached to a plastic cell having a size of 100 mm×100 mm and a thickness of 400 μm, and made of a thermoplastic resin or a thermosetting resin, and when the cell is left at a temperature of 60°C and humidity of 95% for 100 hours, an amount of warping at each of four corners of the cell is ±3.0 mm or less.

[Claim 4] The polarizing plate according to claim 3, wherein the thermoplastic resin comprises at least one selected from the group consisting of polycarbonate, polyalylate, polyether sulfone, polysulfone, polyester, polymethyl methacrylate, polyetherimide and polyamide; and the thermosetting resin comprises at least one selected from the group consisting of epoxy resin, unsaturated polyester, polydiallyl phthalate and polyisobonyl methacrylate.

[Claim 5] The polarizing plate according to any of claims 1 to 4, further comprising a reflector or a transreflector attached to the polarizing plate.

[Claim 6] The polarizing plate according to any of claims 1 to 4, further comprising a retardation plate or a λ plate attached to the polarizing plate.

[Claim 7] The polarizing plate according to any of claims 1 to 4, further comprising a viewing angle compensating film attached to the polarizing plate.

[Claim 8] The polarizing plate according to any of claims 1 to 4, further comprising a brightness-enhanced film attached to the polarizing plate.

[Claim 9] A liquid crystal display comprising: on at least one side of a liquid crystal cell, a polarizer according to any claims 1 to 8.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical field to which the invention pertains]

The present invention relates to a polarizing plate used for a liquid crystal display (hereinafter, also referred to as LCD) and a liquid crystal display using such a polarizing plate.

[0002]

[Prior Art]

Recently, the demand for LCDs used for devices, such as personal computers has increased sharply. Applications for LCDs have also broadened. Recently, LCDs are used for monitoring as well.

[0003]

A polarizing plate used for a LCD may be manufactured, for example, by a method including the steps of: dyeing a polyvinyl alcohol (hereinafter, also referred to as PVA) film with dichroic iodine or a dichroic dyestuff; crosslinking the film with boric acid, borax, or the like; stretching the film uniaxially, followed by drying the film and sticking it to a protective layer such as a triacetylcellulose (hereinafter, also referred to as TAC) film. The respective steps of dyeing, crosslinking and stretching are not necessarily carried out separately and can be carried out simultaneously. Furthermore, there is no limitation on the order of the steps.

[0004]

[Problem to be solved by the invention]

When a polarizer is used after being formed, it may deteriorate due to problems in handling or the influence of moisture. Therefore, as mentioned above, in general, protective layers, such as triacetylcellulose films etc., are attached to both surfaces of the polarizer, thereby producing a polarizing plate.

[0005]

In the above-mentioned configuration, when the polarizing plate is cut out into a size on a liquid crystal panel, both surfaces of the polarizer are covered with the protective layers such as triacetylcellulose films etc. but the polarizer made of a hydrophilic high polymer film is exposed at the sides of the cut-out polarizing plate. As a result, in conventional polarizing plates used for liquid crystal displays have a problem in that the change in dimension may be increased due to the change of moisture in the polarizer when left at high humidity for a long time. This may lead to problems in handling a panel when a liquid crystal panel is equipped, or to deterioration of the polarizing function.

[0006]

It is therefore an object of the present invention to provide a polarizing plate having excellent humidity durability, and a liquid crystal display using such a polarizing plate.

[0007]

[Means for solving problem]

In one aspect of the present invention, the polarizing plate includes a polarizer having all surfaces and sides covered with low moisture-permeable layers having moisture permeability of 310 g/m^2·24h or less.

[0008]

In the polarizing plate of the present invention, it is preferable that a rate of change in dimension of the polarizer in the uniaxially stretching direction is ±0.1% or less after left at a temperature of 60°C and humidity of 95% for 100 hours.

[0009]

Furthermore, it is preferable that the polarizing plate is formed into a size of 90 mm × 90 mm and attached to a plastic cell having a size of 100 mm × 100 mm and a thickness of 400 μm and made of a thermoplastic resin or a thermosetting resin, and when the cell is left at a temperature of 60°C and humidity of 95% for 100 hours, the amount of warping at four corners of the cell is ±3.0 mm or less.

[0010]

Furthermore, it is preferable that the thermoplastic resin is at least one selected from the group consisting of polycarbonate, polyalylate, polyether sulfone, polysulfone, polyester, polymethyl methacrylate, polyetherimide, and polyamide, and that the thermosetting resin is at least one selected from the group consisting of epoxy resin, unsaturated polyester, polydiaryl phthalate and polyisobonyl methacrylate.

[0011]

Furthermore, it is preferable that the polarizing plate of the present invention includes a reflector or a transreflector attached to the polarizing plate.

[0012]

Furthermore, it is preferable that the polarizing plate of the present invention includes a retardation plate or a λ plate attached to the polarizing plate.

[0013]

Furthermore, it is preferable that the polarizing plate of the present invention includes a viewing angle compensating film attached to the polarizing plate.

[0014]

Furthermore, it is preferable that the polarizing plate of the present invention includes a brightness-enhanced film attached to the polarizing plate.

[0015]

Next, a liquid crystal display of the present invention uses the above-mentioned polarizing plate for at least one side of a liquid crystal cell.

[0016]

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

In the present invention, all surfaces and sides of a polarizer are provided with low moisture-permeable layers having moisture permeability of 310 $g/m^2 \cdot 24h$ or less. As a result, the change in dimension of the polarizing plate may be reduced even if the polarizing plate is left at high humidity for a long period of time.

[0017]

An example of a method for providing the low moisture-permeable layer on the sides of the polarizing plate may include, for example, a method of directly coating a low moisture-permeable resin having moisture permeability of 3.9 $g/m^2 \cdot 24h$ or less, or attaching a low moisture-permeable film having moisture permeability of 310 $g/m^2 \cdot 24h$ or less.

[0018]

Furthermore, by cutting out the polarizer formed by dying with iodine and stretching into a size for an equipped liquid crystal panel, and providing a low moisture-permeable layer directly on the entire surface of the polarizer film.

[0019]

In a basic configuration of a polarizing plate used in the present invention, a transparent protective film may be adhered to one side or both sides of the polarizer as a protective layer. The transparent protective film may be made of a polyvinyl alcohol-based polarizing film containing dichroic substance, and the like. The transparent protective film may be adhered via an appropriate adhesive layer, for example, a layer of adhesive made of, for example, a vinyl alcohol-based polymer.

[0020]

A polarizer (polarizing film) made of an appropriate vinyl alcohol-polymer film that are known in the art, for example, polyvinyl alcohol film, a partially formalized polyvinyl alcohol film, or the like, is subjected to appropriate treatment such as dyeing with dichroic substances such as iodine and a dichroic dyestuff, stretching, crosslinking into any suitable orders and manners. Any polarizer can be used, as long as it allows linearly polarized light to pass through the film when natural light enters. In particular, a polarizer with an excellent light transmittance and a polarization degree may be preferred.

[0021]

As a material for the protective film forming a transparent protective layer provided on one side or both sides of the polarizer (polarizing film), an appropriate transparent film can be used. As the polymer, for example, an acetate-based resin such as triacetylcellulose is generally used. However, the polymer is not necessarily limited thereto.

[0022]

When some factors such as polarizing properties and durability are taken into consideration, a preferred transparent protective film may be a triacetylcellulose film having a surface saponified with alkali or the like. The transparent protective film to be provided on both surfaces of a polarizing film may be a film having surface polymers distinguished from the polymers on the backside.

[0023]

The transparent protective film used for the protective layer may be subject to treatment for providing properties such as hard coating, antireflection, anti-sticking, dispersion, or anti-glaring, as long as the advantages of the present invention are not lost. Hard coating treatment may be carried out to prevent scratches on the surfaces of the polarizing plate by, for example, applying a surface of the transparent protective film with a coating film of a hardening resin (e.g., a silicon-based ultraviolet hardening resin) having excellent hardness and smoothness, etc.

[0024]

Antireflection treatment may be carried out to prevent reflection of outdoor daylight on the surface of the polarizing plate by, for example, forming an anti-reflection film in a conventional manner. Furthermore, anti-sticking treatment may be carried out to prevent adjacent layers from sticking to each other. Anti-glaring treatment may be carried out to prevent

visibility of light passing through the polarizing plate from being hindered by outdoor daylight reflected on the surface of the polarizing plate. The anti-glaring treatment can be carried out by providing microscopic asperities on a surface of a transparent protective film in an appropriate manner, for example, by roughening the surface by sand-blasting or embossing, by blending transparent particles, or the like.

[0025]

An example of the above-mentioned transparent fine particles includes silica, alumina, titania, zirconia, stannic oxide, indium oxide, cadmium oxide, antimony oxide or the like, which have an average particle diameter ranging from 0.5 μm to 20 μm. Inorganic fine particles having electroconductivity may also be used. Alternatively, organic fine particles including, for example, crosslinked or uncrosslinked polymer particles, etc. may be used. The amount of the transparent fine particles may range generally from 2 parts by weight to 70 parts by weight, and particularly from 5 parts by weight to 50 parts by weight for 100 parts by weight of the transparent resin.

[0026]

An anti-glare layer including transparent fine particles can be provided as the transparent protective layer or a coating layer applied onto the surface of the transparent protective layer. The anti-glare layer may also function as a diffusion layer to diffuse light passing through the polarizing plate in order to enlarge viewing angle (this function is referred to as a viewing angle compensating function). The above-mentioned layers such as the antireflection layer, the anti-sticking layer, the diffusion layer, and the anti-glare layer can be provided separately from the transparent protective layer as an optical layer, for example, in sheet form including the above-mentioned layers.

[0027]

There is no specific limitation on the treatment for adhering the polarizer (polarizing film) to the transparent protective film that is a protective layer. Adhesion may be carried out, for example, by using an adhesive such as an adhesive including a vinyl alcohol-based polymer, or an adhesive including at least a water-soluble crosslinking agent of vinyl alcohol-based polymer such as boric acid, borax, glutaraldehyde, melamine and oxalic acid. A layer of such an adhesive can be formed by, for example, applying and drying an aqueous solution. In preparation of the aqueous

solution, other additives, a catalyst such as an acid can be blended if necessary.

[0028]

In a practical use, a polarizer may be used as an optical member that is laminated onto another optical layer. Although there is no specific limitation on the optical layer, one or two or more of appropriate optical layer(s) applicable for formation of a liquid crystal display, etc. can be used. An example of an optical layer includes, for example, a reflector, a transreflector, a retardation plate (such as a λ plate like a half wavelength plate and a quarter wavelength plate), a viewing angle compensating film, a brightness-enhanced film, and the like. Examples of a polarizing plate include a reflective polarizing plate or a semitransparent polarizing plate formed by laminating a reflector or a transreflector on the above-mentioned polarizing plate including a polarizer and a protective layer according to the present invention; an elliptical polarizing plate or a circular polarizing plate formed by laminating a retardation plate on the above-mentioned polarizing plate including a polarizer and a protective layer; a polarizing plate formed by laminating a viewing angle compensating film on the above-mentioned polarizing plate including a polarizer and a protective layer; and a polarizing plate formed by laminating a brightness-enhanced film on the above-mentioned polarizing plate including a polarizer and a protective layer.

[0029]

A reflector may be provided on a polarizing plate to form a reflective polarizing plate. In general, such a reflective polarizing plate is provided on the backside of a liquid crystal cell to make a liquid crystal display, etc. to display by reflecting incident light from a visible side (display side). The reflective polarizing plate has some advantages, for example, light sources such as backlight need not be built in, and thus the liquid crystal display can be thinner.

[0030]

The reflective polarizing plate can be formed in an appropriate manner such as attaching a reflecting layer made of, for example, metal on one surface of the polarizing plate via, for example, the above-mentioned transparent protective film as required. As a specific example, a reflecting layer formed by attaching a foil of a reflective metal such as aluminum or a deposition film on one surface of the transparent protective film that has been subjected to matting treatment as required.

[0031]

Another example of a reflective polarizing plate includes the above-mentioned transparent protective film having a surface of microscopic asperities due to fine particles contained and a reflecting layer corresponding to the microscopic asperities. The reflecting layer having a surface with microscopic asperities diffuses incident light irregularly, so that directivity and glare can be prevented and irregularity in color tones can be controlled. This transparent protective film can be formed by attaching a metal directly onto a surface of a transparent protective film by any appropriate methods including deposition such as vacuum deposition, and plating such as ion plating and sputtering.

[0032]

Furthermore, the reflector can be used as, for example, a reflecting sheet formed by providing a reflecting layer onto an appropriate film similar to the transparent protective film, instead of the above-mentioned method of producing a reflector directly on the transparent protective film of the polarizing plate. The reflecting layer of the reflector, which generally is made of metal, is preferably used with its surface covered with a film, a polarizing plate or the like, so the reduction of reflectance due to oxidation can be prevented, the initial reflectance can be maintained for a long time, an additional protective layer need not be formed, or the like.

[0033]

A semitransparent polarizing plate may be obtained by using a semitransparent reflecting layer such as a half mirror, which reflects light and transmits light, as the reflecting layer in the above. In general, the semitransparent polarizing plate is provided on the backside of a liquid crystal cell. When a liquid crystal display is used in a relatively bright atmosphere, the semitransparent polarizing plate allows an incident light from the visible side (display side) to be reflected to display an image, while in a relatively dark atmosphere, an image is displayed by using a built-in light source such as a backlight in the backside of the semitransparent polarizing plate. In other words, the semitransparent polarizing plate can be used to form a liquid crystal display that can save energy for a light source such as a backlight under a bright atmosphere, while a built-in light source can be used under a relatively dark atmosphere.

[0034]

Next, an elliptical polarizing plate or a circular polarizing plate in

which a retardation plate is additionally laminated on the above-mentioned polarizing plate including a polarizer and a protective layer will be described.

[0035]

A retardation plate is used for modifying linearly polarized light to either elliptical polarized light or circular polarized light, modifying elliptical polarized light or circular polarized light to linearly polarized light, or modifying a polarization direction of linearly polarized light. In particular, a retardation plate called a quarter wavelength plate (λ/4 plate) is used for modifying linearly polarized light to circular polarized light, and for modifying circular polarized light to linearly polarized light. A half wavelength plate (λ/2 plate) is generally used for modifying a polarization direction of linearly polarized light.

[0036]

The elliptical polarizing plate is effective in compensating (preventing) colors (blue or yellow) generated due to birefringence in a liquid crystal layer of a super twist nematic (STN) liquid crystal display so as to provide a black-and-white display free from the above-mentioned colors. Controlling three-dimensional refractive index may be further preferred because it can compensate (prevent) colors observed when looking at a screen of the liquid crystal display from an oblique direction. A circular polarizing plate is effective, for example, in adjusting color tones of an image of a reflective liquid crystal display that has a color image display, and it also serves to prevent reflection as well.

[0037]

Examples of a retardation plate includes, for example, a birefringent film prepared by stretching an appropriate polymer film, an oriented film of a liquid crystal polymer, and an oriented layer of a liquid crystal polymer that is supported by a film, and the like. Examples of the polymer include, polycarbonate, polyvinyl alcohol, polystyrene, polymethyl methacrylate, polyolefins such as polypropylene, polyalylate, and polyamide. Furthermore, the incline-oriented film may be prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under the influence of a shrinkage force by heat, or by orienting obliquely a liquid crystal polymer.

[0038]

Next, a polarizing plate in which a viewing angle compensating film is additionally laminated on the above-mentioned polarizing plate including a

polarizer and a protective layer will be described.

[0039]

A viewing angle compensating film is used for widening a viewing angle so that an image can be seen relatively clearly even when a screen of a liquid crystal display is viewed from a slightly oblique direction.

[0040]

As the viewing angle compensating film, a triacetylcellulose film etc. coated with a discotic liquid crystal, or a retardation plate may be used. While an ordinary retardation plate is a birefringent polymer film that is stretched uniaxially in the face direction, a retardation plate used as the viewing angle compensating film is a two-way stretched film such as a birefringent polymer film stretched biaxially in the face direction, or an incline-oriented polymer film with a controlled refractive index in the thickness direction that is stretched uniaxially in the face direction and stretched also in the thickness direction. The incline-oriented film is prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under an influence of shrinkage force by heat, or by obliquely orienting a liquid crystal polymer. A polymer as a material of the retardation plate may be similar to the polymer used for the above-mentioned retardation plate.

[0041]

A polarizing plate in which a brightness-enhanced film is attached to the above-mentioned polarizing plate including a polarizer and a protective layer is generally arranged on the backside of a liquid crystal cell. When natural light enters by the backlight of the liquid crystal display etc. and reflection from the backside and the like, the brightness-enhanced film reflects linearly polarized light of a predetermined polarizing axis or circularly polarized light in a predetermined direction, while transmitting other light. The polarizing plate in which the brightness-enhanced film is laminated on the above-mentioned polarizing plate including a polarizer and a protective layer allows entrance of light from a light source such as a backlight to obtain transmitted light in a predetermined polarization state, while reflecting light other than light in the predetermined polarization state. Light reflecting by the brightness-enhanced film is reversed through a reflecting layer or the like arranged additionally behind the brightness-enhanced film. The reversed light is allowed to re-enter the

brightness-enhanced plate. The re-entering light is transmitted partly or entirely as light in a predetermined polarization state so as to increase the amount of light passing through the brightness-enhanced film and polarized light that is hardly absorbed in the polarizer is supplied so as to increase the amount of light available for the liquid crystal display, etc. Thus, the brightness can be improved. When light enters through a polarizer from the backside of the liquid crystal cell by using a backlight or the like without using any brightness-enhanced films, most of the light having a polarization direction inconsistent with the polarization axis of the polarizer is absorbed in the polarizer but not transmitted by the polarizer. Depending on the characteristics of the polarizer, about 50% of light is absorbed in the polarizer, which decreases the quantity of light available in the liquid crystal display, or the like, and makes the image dark. The brightness-enhanced film repeatedly prevents light having a polarization direction to be absorbed in the polarizer from entering the polarizer to reflect the light on the brightness-enhanced film, and reverses the light through a reflecting layer or the like provided behind the brightness-enhanced film to make the light re-enter the brightness-enhanced plate. Because the brightness-enhanced film transmits the polarized light that is reflected and reversed between the brightness-enhanced film and the reflecting layer only if the polarized light has a polarization direction to pass the polarizer, light from a backlight or the like can be used efficiently for displaying images of a liquid crystal display in order to provide a bright screen.

[0042]

Examples of a brightness-enhanced film include, for example, a film which transmits a linearly polarized light having a predetermined polarization axis and reflects other light, for example, a multilayer thin film of a dielectric or a multilayer laminate of thin films with varied refraction aeolotropy; a film that reflects either clockwise or counterclockwise circular polarized light while transmitting other light, for example, a cholesteric liquid crystal layer, more specifically, an oriented film of a cholesteric liquid crystal polymer or an oriented liquid crystal layer supported on a supportive substrate, or the like.

[0043]

Therefore, with the brightness-enhanced film transmitting a linearly polarized light having a predetermined polarization axis, the transmitted light directly enters the polarizing plate with the polarization axes matched,

so that absorption loss due to the polarizing plate is controlled and the light can be transmitted efficiently. On the other hand, with the brightness-enhanced film transmitting a circular polarized light, such as a cholesteric liquid crystal layer, preferably, the transmission circular polarized light is converted to linearly polarized light before entering the polarizing plate in an aspect of controlling of the absorption loss, though the circular polarized light can enter the polarizer directly. Circular polarized light can be converted to linearly polarized light by using a quarter wavelength plate as a retardation plate.

[0044]

A retardation plate having a function as a quarter wavelength plate in a wide wave range of a visible light region can be obtained, for example, by overlapping a retardation layer functioning as a quarter wavelength plate for monochromatic light such as light having 550 nm wavelength and another retardation plate showing a separate optical retardation property, for example, a retardation plate functioning as a half wavelength plate. Therefore, a retardation plate arranged between a polarizing plate and a brightness-enhanced film can include a single layer or at least two layers of retardation layers.

[0045]

A cholesteric liquid crystal layer also can be provided by combining layers different in the reflection wavelength and it can be configured by overlapping two or at least three layers. As a result, the obtained retardation plate can reflect circular polarized light in a wide wavelength region of a visible light region, thus providing transmission circular polarized light in a wide wavelength region.

[0046]

Furthermore, a polarizing plate can be formed by laminating a polarizing plate and two or at least three optical layers like the above-mentioned polarization separating type polarizing plate. Therefore, the polarizing plate can be a reflective elliptical polarizing plate, a semitransparent elliptical polarizing plate or the like, which is prepared by combining the above-mentioned reflective polarizing plate or a semitransparent polarizing plate with a retardation plate. An optical member including a lamination of two or at least three optical layers can be formed in a method of laminating layers separately in a certain order for manufacturing a liquid crystal display etc. or in a method for preliminary

lamination. Because an optical member that has been laminated previously has excellent stability in quality and assembling operability, efficiency in manufacturing a liquid crystal display can be improved. Any appropriate adhesion means such as a pressure sensitive adhesive layer can be used for lamination.

[0047]

The pressure sensitive adhesive layer can be provided on a polarizing plate or on an optical member for adhesion with other members such as a liquid crystal cell. The adhesive layer can be formed by the conventional appropriate pressure sensitive adhesives such as an acrylic pressure sensitive adhesive. Pressure sensitive adhesives having a low moisture absorption coefficient and an excellent heat resistance may be preferred from aspects of prevention of foaming or peeling caused by moisture absorption, prevention of decrease in the optical properties and warping of a liquid crystal cell caused by difference in thermal expansion coefficients, formation of a high quality liquid crystal display having excellent durability, etc. The pressure sensitive adhesive layer may contain fine particles to obtain optical diffusivity. Pressure sensitive adhesive layers can be provided on necessary surfaces if required. For example, the polarizing plate including a polarizer and a protective layer can be provided with a pressure sensitive adhesive layer on at least one surface of the protective layer as required.

[0048]

When a pressure sensitive adhesive layer provided on the polarizing plate or the optical member is exposed on the surface, preferably, the pressure sensitive adhesive layer is temporarily covered with a separator for preventing contamination by the time the pressure sensitive adhesive layer is used. The separator can be made of an appropriate thin sheet by coating a peeling agent if required. Examples of a peeling agent include, for example, a silicone-based peeling agent, a long-chain alkyl-based peeling agent, a fluorine-based peeling agent, a peeling agent including molybdenum sulfide, or the like.

[0049]

The above-described members forming a polarizing plate and an optical member, such as a polarizing film, a transparent protective film, an optical layer, and a pressure sensitive adhesive layer can have ultraviolet absorption power by treating with an ultraviolet absorber such as, for example, an ester salicylate compound, a benzophenone compound, a

benzotriazole compound, a cyanoacrylate compound, a nickel complex salt compound, and the like.

[0050]

The above-mentioned polarizing plate can preferably be used for formation of various apparatus such as a liquid crystal display. The liquid crystal display can be produced as conventionally known structures, such as transmission type, reflection type, or a transmission-reflection type. A liquid crystal cell forming the liquid crystal display can be selected arbitrarily from appropriate cells such as active matrix driving type represented by a thin film transistor, a simple matrix driving type represented by a twist nematic type and a super twist nematic type.

[0051]

When polarizing plates or optical members are provided on both sides of a liquid crystal cell, the polarizing plates or the optical members on both sides can be the same or different. Moreover, for forming a liquid crystal display, one or at least two layers of appropriate members such as a prism array sheet, a lens array sheet, an optical diffuser, or a backlight can be arranged at appropriate positions.

[0052]

[Example]

Hereinafter, the present invention will be explained more specifically with reference to Examples and Comparative Examples.

[0053]

(Example 1)

Figure 1 is a cross-sectional view showing a polarizing plate according to Example 1 of the present invention. In Figure 1, an adhesive layer, which is usually used, is omitted.

[0054]

TAC films 2 as protective layers having a thickness of 40 μm are attached to both surfaces of a polarizer 1 made of a 30 μm-thick PVA film containing iodine, while TAC films 3 as protective layers having a thickness of 40 μm are attached also to both sides of the polarizer 1. Thus, a polarizing plate was produced. The moisture permeability of this 40 μm-thick TAC film was 120 $g/m^2 \cdot 24h$.

[0055]

(Example 2)

Figure 2 is a cross-sectional view showing a polarizing plate according

to Example 2 of the present invention. In Figure 2, an adhesive layer, which is usually used, is omitted.

[0056]

TAC films 5 as protective layers having a thickness of 40 μm are attached to both surfaces of a polarizer 4 made of a 30 μm-thick PVA film containing iodine, while TAC resin 6 as protective layers having a thickness of 20 μm are coated on both sides of the polarizer 4. Thus, a polarizing plate was produced. The moisture permeability of this 20 μm-thick TAC resin was 0.59 $g/m^2 \cdot 24h$.

[0057]

(Comparative Example 1)

A polarizing plate was prepared by the same method as in Example 1 except that protective films are not attached on both sides of the polarizer.

[0058]

(Comparative Example 2)

A polarizing plate was prepared by the same method as in Example 2 except that protective layers are not coated on both sides of the polarizer.

[0059]

(Humidity durability test)

After the polarizing plates produced in Examples 1 and 2 and Comparative Examples 1 and 2 were left at a temperature of 60°C and humidity of 95% for 100 hours, the rate of change in dimension of the polarizing plate in the longitudinal direction was measured. The rate of change in dimension was calculated from the following formula:

(dimension of polarizing plate in the longitudinal direction after left at humidity – dimension of original polarizing plate in the longitudinal direction) / (dimension of original polarizing plate in the longitudinal direction) × 100.

[0060]

Next, the polarizing plates produced in Examples 1 and 2 and Comparative Examples 1 and 2 were attached to a plastic cell (100 mm × 100 mm) made of epoxy resin and left at a temperature of 60°C and humidity of 95% for 100 hours, and thereafter maximum values of warping amount at four corners of the cell were measured.

[0061]

Table 1 shows the results.

[0062]

[Table 1]

	rate of change in dimension (%)	maximum value of warping amount (mm)
Example 1	0.057	2.5
Example 2	0.017	2.2
Comparative Example 1	0.408	3.3
Comparative Example 2	0.253	3.1

[0063]

As is apparent from Table 1, in Examples 1 and 2, the rate of change in dimension is ±0.1% or less. On the other hand, in Comparative Examples 1 and 2, the rate of change in dimension is more than ±0.1%.

[0064]

Furthermore, in Examples 1 and 2, the warping amount is ± 3.0 mm or less. On the other hand, in Comparative Examples 1 and 2, the warping amount is more than ±3.0 mm.

[0065]

These results show that in the polarizing plate of the present invention, the change in dimension is small even if it is left at high humidity for a long time, and there are no problems in handling of a panel when the liquid crystal panel is equipped.

[0066]

[Effect of the invention]

As mentioned above, according to the present invention, all surfaces and sides of the polarizer are covered with low moisture-permeable layers having moisture permeability of 310 g/m^2·24h or less, and thus it is possible to provide a polarizing plate having an excellent humidity durability and a liquid crystal display using such a polarizing plate.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Figure 1 is a cross-sectional view showing a polarizing plate according to Example 1 of the present invention.

Figure 2 is a cross-sectional view showing a polarizing plate according to Example 2 of the present invention.

[Explanation of letters or numerals]

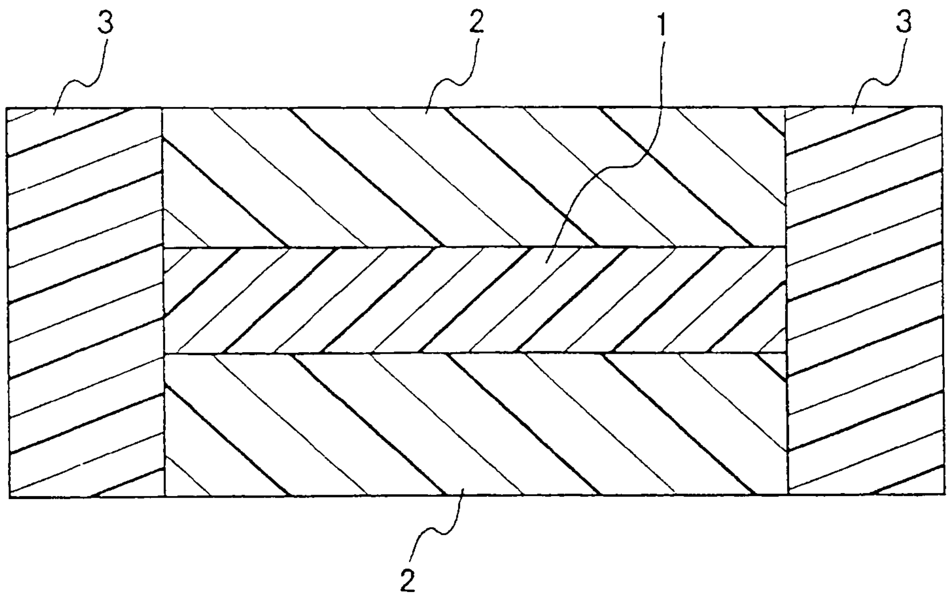
1,4: polarizer

2,3,5: TAC film

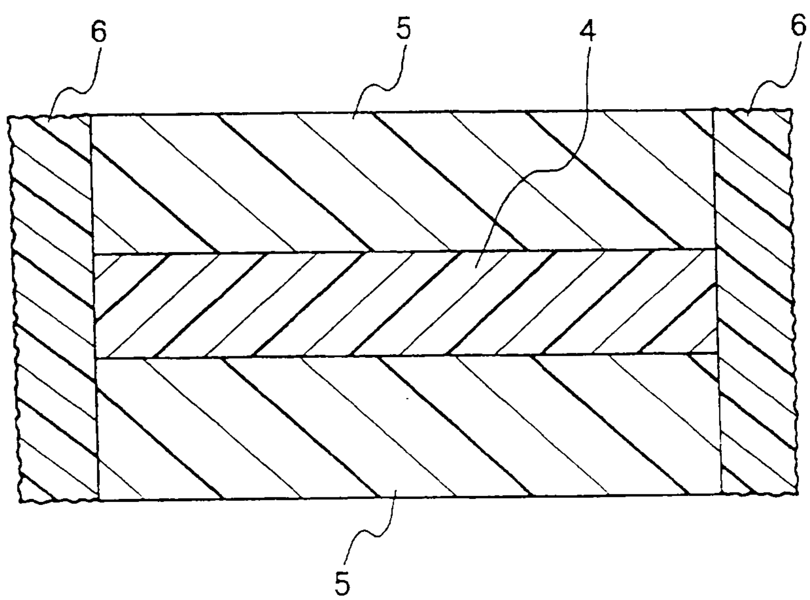
6: TAC resin

[Document Name] Drawing

[Figure 1]



[Figure 2]



[Document name] Abstract

[Abstract]

[Problem] To provide a polarizing plate having excellent moisture durability and a liquid crystal display using the same.

[Means for solving problem] The polarizing plate is produced by covering all surfaces and sides of a polarizer with low moisture-permeable layers having moisture permeability of 310 $g/m^2 \cdot 24h$ or less. The rate of change in dimension of the polarizer in the uniaxially stretched direction is $\pm 0.1\%$ or less after left at a temperature of 60°C and humidity of 95% for 100 hours.

[Selected Drawings] Fig. 1

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Youichirou SUGINO et al.

Serial Number: 10/072,804 Group Art Unit: 2871

Filed: February 8, 2002 Examiner: CHOWDHURY, TARIFUR RASHID

For: POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY USING THE SAME

MARKED-UP COPY OF APPLICATION

showing changes with respect to prior Japanese patent application

No. 2000-238724 (JP'724) filed on August 7, 2000

~~[DOCUMENT NAME] SPECIFICATION~~

~~[TITLE OF THE INVENTION]~~ POLARIZING PLATE AND LIQUID CRYSTAL ~~DISPLAY~~ DISPLAY USING THE SAME

~~[DETAILED DESCRIPTION OF THE INVENTION]~~

~~[0001]~~

~~[Technical field to which the invention pertains]~~ BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a polarizing plate used for a liquid crystal display (hereinafter~~, also referred to as~~ LCD) and a liquid crystal display using such a polarizing plate.

~~[0002]~~

~~[Prior Art]~~

2. Description of the Prior Art

Recently, the demand for LCDs used for devices, such as personal computers has increased sharply. Applications for LCDs have also broadened. Recently, LCDs are used for monitoring as well.

~~[0003]~~

A polarizing plate used for a LCD may be manufactured, for example, by a method including the steps of: dyeing a polyvinyl alcohol (~~hereinafter, also referred to as~~ PVA) film with dichroic iodine or a dichroic dyestuff; crosslinking the film with boric acid, borax, or the like; stretching the film uniaxially, followed by drying the film and sticking it to a protective layer such as a triacetylcellulose (hereinafter~~, also referred to as~~ TAC) film. The respective steps of dyeing, crosslinking and stretching are not necessarily carried out separately and can be carried out simultaneously. Furthermore, there is no limitation on the order of the steps.

~~[0004]~~

~~[Problem to be solved by the invention]~~

When a polarizer is used after being formed, it may deteriorate due to problems in handling or the influence of moisture. Therefore,~~as mentioned above, in general,~~ protective layers, such as triacetylcellulose films etc., are attached to both surfaces of the polarizer, thereby producing a polarizing plate.

~~[0005]~~

In the above-mentioned configuration, when the polarizing plate is cut out into a size on a liquid crystal panel, both surfaces of the polarizer are covered with the

protective layers such as triacetylcellulose films etc. but the polarizer made of a hydrophilic high polymer film is exposed at the sides of the cut-out polarizing plate. As a result, in conventional polarizing plates used for liquid crystal displays have a problem in that the change in dimension may be increased due to the change of moisture in the polarizer when left at high humidity for a long time. This may lead to problems in handling a panel when a liquid crystal panel is equipped, or to deterioration of the polarizing function.

~~[0006]~~

SUMMARY OF THE INVENTION

~~It is therefore an object of~~In one aspect, the present invention ~~to provide~~relates to a polarizing plate having~~excellent~~ humidity durability, and a liquid crystal display using such a polarizing plate.

~~[0007]~~

~~[Means for solving problem]~~

In one ~~aspect~~embodiment of the present invention, the polarizing plate includes a polarizer having all surfaces and sides covered with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less.

~~[0008]~~

In some embodiments, the polarizing plate ~~of the present invention, it is preferable that~~has a rate of change in dimension~~of the polarizer~~ in the uniaxially stretching direction ~~is~~of ±0.1% or less after left at a temperature of 60°C and humidity of 95% for 100 hours.

~~[0009]~~

~~Furthermore, it is preferable that~~In some embodiments, the polarizing plate is formed into a size of 90 mm×90 mm and attached to a plastic cell having a size of 100 mm×100 mm and a thickness of 400 μm and made of a thermoplastic resin or a thermosetting resin, ~~and~~such that when the cell is left at a temperature of 60°C and humidity of 95% for 100 hours, the amount of warping at four corners of the cell is ±3.0 mm or less.

~~[0010]~~

~~Furthermore, it is preferable that~~In some embodiments, the thermoplastic resin is at least one selected from the group consisting of polycarbonate, polyalylate, polyether sulfone, polysulfone, polyester, polymethyl methacrylate, ~~polyetherimide, and polyamide,~~ ~~and that~~polyetherimide. In some embodiments, polyamide; and the thermosetting resin is at least one selected from the group consisting of epoxy resin, unsaturated polyester, polydiaryl phthalate and polyisobonyl methacrylate.

~~[0011]~~

~~Furthermore, it is preferable that~~In some embodiments, the polarizing plate~~of the present invention~~ includes a reflector or a transreflector attached to the polarizing plate.

~~[0012]~~

~~Furthermore, it is preferable that~~In some embodiments, the polarizing plate~~of the present invention~~ includes a retardation plate or a λ plate attached to the polarizing plate.

~~[0013]~~

~~Furthermore, it is preferable that~~In some embodiments, the polarizing plate~~of the present invention~~ includes a viewing angle compensating film attached to the polarizing plate.

[0014]

~~Furthermore, it is preferable that~~In some embodiments, the polarizing plate~~of the present invention~~ includes a brightness-enhanced film attached to the polarizing plate.

~~[0015]~~

~~Next,~~In some embodiments of the invention, a liquid crystal display~~of the present invention~~ uses ~~the above-mentioned~~a polarizing plate ~~for~~in accordance with the invention on at least one side of a liquid crystal cell.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Figure 1 is a cross-sectional view showing a polarizing plate according to Example 1 of the present invention.

Figure 2 is a cross-sectional view showing a polarizing plate according to Example 2 of the present invention.

~~[Explanation of letters or numerals]~~

~~1,4: polarizer~~

~~2,3,5: TAC film~~

~~6: TAC resin~~

~~[0016]~~

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

In one embodiment of the present invention, all surfaces and sides of a polarizer are provided with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less. As a result, the change in dimension of the polarizing plate may be reduced even if the polarizing plate is left at high humidity for a long period of time.

~~[0017]~~

An example of a method for providing the low moisture-permeable layer on the sides of the polarizing plate may include, for example, a method of directly coating a low moisture-permeable resin having moisture permeability of 3.9 g/m^2□24h or less, or attaching a low moisture-permeable film having moisture permeability of 310 g/m^2□24h or less.

~~[0018]~~

~~Furthermore, by~~Another method may include cutting out the polarizer formed by dying with iodine and stretching into a size for an equipped liquid crystal panel, and providing a low moisture-permeable layer directly on the entire surface of the polarizer film.

~~[0019]~~

In a basic configuration of a polarizing plate ~~used in~~according to the present invention, a transparent protective film may be adhered to one side or both sides of the polarizer as a protective layer. The transparent protective film may be made of a polyvinyl alcohol-based polarizing film containing dichroic substance, and the like. The transparent protective film may be adhered via an appropriate adhesive layer, for example, a layer of adhesive made of, for example, a vinyl alcohol-based polymer.

~~[0020]~~

A polarizer (polarizing film) made of an appropriate vinyl alcohol-polymer film that are known in the art, for example, polyvinyl alcohol film, a partially formalized polyvinyl alcohol film, or the like, is subjected to appropriate treatment such as dyeing with dichroic substances such as iodine and a dichroic dyestuff, stretching, crosslinking into any suitable orders and manners. Any polarizer can be used, as long as it allows linearly polarized light to pass through the film when natural light enters. In ~~particular,~~some embodiments, a polarizer with an excellent light transmittance and a polarization degree may be preferred.

~~[0021]~~

As a material for the protective film forming a transparent protective layer provided on one side or both sides of the polarizer (polarizing film), an appropriate transparent film can be used. As the polymer, for example, an acetate-based resin such as triacetylcellulose ~~is generally~~may be used. However, the polymer is not necessarily limited thereto.

~~[0022]~~

When some factors such as polarizing properties and durability are taken into consideration, a preferred transparent protective film may be a triacetylcellulose film having a surface saponified with alkali or the like. The transparent protective film to be

provided on both surfaces of a polarizing film may be a film having surface polymers distinguished from the polymers on the backside.

~~[0023]~~

The transparent protective film used for the protective layer may be subject to treatment for providing properties such as hard coating, antireflection, anti-sticking, dispersion, or anti-glaring, as long as the advantages of the present invention are not lost. Hard coating treatment may be carried out to prevent scratches on the surfaces of the polarizing plate by, for example, applying a surface of the transparent protective film with a coating film of a hardening resin (e.g., a silicon-based ultraviolet hardening resin) having excellent hardness and smoothness, etc.

~~[0024]~~

Antireflection treatment may be carried out to prevent reflection of outdoor daylight on the surface of the polarizing plate by, for example, forming an anti-reflection film in a conventional manner. ~~Furthermore, anti-sticking~~Anti-sticking treatment may be carried out to prevent adjacent layers from sticking to each other. Anti-glaring treatment may be carried out to prevent visibility of light passing through the polarizing plate from being hindered by outdoor daylight reflected on the surface of the polarizing plate. The anti-glaring treatment can be carried out by providing microscopic asperities on a surface of a transparent protective film in an appropriate manner, for example, by roughening the surface by sand-blasting or embossing, by blending transparent particles, or the like.

~~[0025]~~

An example of~~the above-mentioned~~ transparent fine particles includes silica, alumina, titania, zirconia, stannic oxide, indium oxide, cadmium oxide, antimony oxide or the like, which have an average particle diameter ranging from 0.5 μm to 20 μm. Inorganic fine particles having electroconductivity may also be used. Alternatively, organic fine particles including, for example, crosslinked or uncrosslinked polymer particles, etc. may be used. The amount of the transparent fine particles may range generally from 2 parts by weight to 70 parts by weight, and particularly from 5 parts by weight to 50 parts by weight for 100 parts by weight of the transparent resin.

~~[0026]~~

An anti-glare layer including transparent fine particles ~~can~~may be provided as the transparent protective layer or a coating layer applied onto the surface of the transparent protective layer. The anti-glare layer may also function as a diffusion layer to diffuse light passing through the polarizing plate in order to enlarge viewing angle (this function is referred to as a viewing angle compensating function). The above-mentioned layers such as the antireflection layer, the anti-sticking layer, the

diffusion layer, and the anti-glare layer ~~can~~may be provided separately from the transparent protective layer as an optical layer, for example, in sheet form including the above-mentioned layers.

[0027]

There is no specific limitation on the treatment for adhering the polarizer (polarizing film) to the transparent protective film that is a protective layer. Adhesion may be carried out, for example, by using an adhesive such as an adhesive including a vinyl alcohol-based polymer, or an adhesive including at least a water-soluble crosslinking agent of vinyl alcohol-based polymer such as boric acid, borax, glutaraldehyde, melamine and oxalic acid. A layer of such an adhesive can be formed by, for example, applying and drying an aqueous solution. In preparation of the aqueous solution, other additives, a catalyst such as an acid can be blended if necessary.

[0028]

In a practical use, a polarizer may be used as an optical member that is laminated onto another optical layer. Although there is no specific limitation on the optical layer, one or two or more of appropriate optical layer(s) applicable for formation of a liquid crystal display, etc. can be used. An example of an optical layer includes, for example, a reflector, a transreflector, a retardation plate (such as a λ plate like a half wavelength plate and a quarter wavelength plate), a viewing angle compensating film, a brightness-enhanced film, and the like. Examples of a polarizing plate include a reflective polarizing plate or a semitransparent polarizing plate formed by laminating a reflector or a transreflector on the above-mentioned polarizing plate including a polarizer and a protective layer according to the present invention; an elliptical polarizing plate or a circular polarizing plate formed by laminating a retardation plate on the above-mentioned polarizing plate including a polarizer and a protective layer; a polarizing plate formed by laminating a viewing angle compensating film on the above-mentioned polarizing plate including a polarizer and a protective layer; and a polarizing plate formed by laminating a brightness-enhanced film on the above-mentioned polarizing plate including a polarizer and a protective layer.

[0029]

A reflector may be provided on a polarizing plate to form a reflective polarizing plate. In general, such a reflective polarizing plate is provided on the backside of a liquid crystal cell to make a liquid crystal display, etc. to display by reflecting incident light from a visible side (display side). The reflective polarizing plate has some advantages, for example, light sources such as backlight need not be built in, and thus the liquid crystal display can be thinner.

[0030]

The reflective polarizing plate can be formed in an appropriate manner such as attaching a reflecting layer made of, for example, metal on one surface of the polarizing plate via, for example, the above-mentioned transparent protective film as required. ~~As~~In a specific example, a reflecting layer may be formed by attaching a foil of a reflective metal such as aluminum or a deposition film on one surface of the transparent protective film that has been subjected to matting treatment as required.

~~[0031]~~

Another example of a reflective polarizing plate includes the above-mentioned transparent protective film having a surface of microscopic asperities due to fine particles contained and a reflecting layer corresponding to the microscopic asperities. The reflecting layer having a surface with microscopic asperities diffuses incident light irregularly, so that directivity and glare can be prevented and irregularity in color tones can be controlled. This transparent protective film can be formed by attaching a metal directly onto a surface of a transparent protective film by any appropriate methods including deposition such as vacuum deposition, and plating such as ion plating and sputtering.

~~[0032]~~

Furthermore, the reflector can be used as, for example, a reflecting sheet formed by providing a reflecting layer onto an appropriate film similar to the transparent protective film, instead of the above-mentioned method of producing a reflector directly on the transparent protective film of the polarizing plate. The reflecting layer of the reflector, which generally is made of metal, is preferably used with its surface covered with a film, a polarizing plate or the like, so the reduction of reflectance due to oxidation can be prevented, the initial reflectance can be maintained for a long time, an additional protective layer need not be formed, or the like.

~~[0033]~~

A semitransparent polarizing plate may be obtained by using a semitransparent reflecting layer such as a half mirror, which reflects light and transmits light, as the reflecting layer in the above. In general, the semitransparent polarizing plate is provided on the backside of a liquid crystal cell. When a liquid crystal display is used in a relatively bright atmosphere, the semitransparent polarizing plate allows an incident light from the visible side (display side) to be reflected to display an image, while in a relatively dark atmosphere, an image is displayed by using a built-in light source such as a backlight in the backside of the semitransparent polarizing plate. In other words, the semitransparent polarizing plate can be used to form a liquid crystal display that can save energy for a light source such as a backlight under a bright atmosphere, while a built-in light source can be used under a relatively dark atmosphere.

[0034]

~~Next,~~An example of an elliptical polarizing plate or a circular polarizing plate in which a retardation plate is additionally laminated on the above-mentioned polarizing plate including a polarizer and a protective layer will now be described.

[0035]

A retardation plate is used for modifying linearly polarized light to either elliptical polarized light or circular polarized light, modifying elliptical polarized light or circular polarized light to linearly polarized light, or modifying a polarization direction of linearly polarized light. In particular, a retardation plate called a quarter wavelength plate ($\lambda/4$ plate) is used for modifying linearly polarized light to circular polarized light, and for modifying circular polarized light to linearly polarized light. A half wavelength plate ($\lambda/2$ plate) is generally used for modifying a polarization direction of linearly polarized light.

[0036]

The elliptical polarizing plate is effective in compensating (preventing) colors (blue or yellow) generated due to birefringence in a liquid crystal layer of a super twist nematic (STN) liquid crystal display so as to provide a black-and-white display free from the above-mentioned colors. Controlling three-dimensional refractive index may be further preferred because it can compensate (prevent) colors observed when looking at a screen of the liquid crystal display from an oblique direction. A circular polarizing plate is effective, for example, in adjusting color tones of an image of a reflective liquid crystal display that has a color image display, and it also serves to prevent reflection as well.

[0037]

Examples of a retardation plate includes, for example, a birefringent film prepared by stretching an appropriate polymer film, an oriented film of a liquid crystal polymer, and an oriented layer of a liquid crystal polymer that is supported by a film, and the like. Examples of the polymer include, polycarbonate, polyvinyl alcohol, polystyrene, polymethyl methacrylate, polyolefins such as polypropylene, polyalylate, and polyamide. ~~Furthermore, the~~The incline-oriented film may be prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under the influence of a shrinkage force by heat, or by orienting obliquely a liquid crystal polymer.

[0038]

~~Next,~~An example of a polarizing plate in which a viewing angle compensating film is additionally laminated on the above-mentioned polarizing plate including a polarizer and a protective layer will now be described.

~~[0039]~~

A viewing angle compensating film is used for widening a viewing angle so that an image can be seen relatively clearly even when a screen of a liquid crystal display is viewed from a slightly oblique direction.

~~[0040]~~

As the viewing angle compensating film, a triacetylcellulose film etc. coated with a discotic liquid crystal, or a retardation plate may be used. While an ordinary retardation plate is a birefringent polymer film that is stretched uniaxially in the face direction, a retardation plate used as the viewing angle compensating film is a two-way stretched film such as a birefringent polymer film stretched biaxially in the face direction, or an incline-oriented polymer film with a controlled refractive index in the thickness direction that is stretched uniaxially in the face direction and stretched also in the thickness direction. The incline-oriented film is prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under an influence of shrinkage force by heat, or by obliquely orienting a liquid crystal polymer. A polymer as a material of the retardation plate may be similar to the polymer used for the above-mentioned retardation plate.

~~[0041]~~

A polarizing plate in which a brightness-enhanced film is attached to the above-mentioned polarizing plate including a polarizer and a protective layer is generally arranged on the backside of a liquid crystal cell. When natural light enters by the backlight of the liquid crystal display etc. and reflection from the backside and the like, the brightness-enhanced film reflects linearly polarized light of a predetermined polarizing axis or circularly polarized light in a predetermined direction, while transmitting other light. The polarizing plate in which the brightness-enhanced film is laminated on the above-mentioned polarizing plate including a polarizer and a protective layer allows entrance of light from a light source such as a backlight to obtain transmitted light in a predetermined polarization state, while reflecting light other than light in the predetermined polarization state. Light reflecting by the brightness-enhanced film is reversed through a reflecting layer or the like arranged additionally behind the brightness-enhanced film. The reversed light is allowed to re-enter the brightness-enhanced plate. The re-entering light is transmitted partly or entirely as light in a predetermined polarization state so as to increase the amount of light passing through the brightness-enhanced film and polarized light that is hardly absorbed in the polarizer is supplied so as to increase the amount of light available for the liquid crystal display, etc. Thus, the brightness can be improved. When light enters through a polarizer from the backside of the liquid crystal cell by using a backlight or the like

without using any brightness-enhanced films, most of the light having a polarization direction inconsistent with the polarization axis of the polarizer is absorbed in the polarizer but not transmitted by the polarizer. Depending on the characteristics of the polarizer, about 50% of light is absorbed in the polarizer, which decreases the quantity of light available in the liquid crystal display, or the like, and makes the image dark. The brightness-enhanced film repeatedly prevents light having a polarization direction to be absorbed in the polarizer from entering the polarizer to reflect the light on the brightness-enhanced film, and reverses the light through a reflecting layer or the like provided behind the brightness-enhanced film to make the light re-enter the brightness-enhanced plate. Because the brightness-enhanced film transmits the polarized light that is reflected and reversed between the brightness-enhanced film and the reflecting layer only if the polarized light has a polarization direction to pass the polarizer, light from a backlight or the like can be used efficiently for displaying images of a liquid crystal display in order to provide a bright screen.

~~[0042]~~

Examples of a brightness-enhanced film include, for example, a film which transmits a linearly polarized light having a predetermined polarization axis and reflects other light, for example, a multilayer thin film of a dielectric or a multilayer laminate of thin films with varied refraction aeolotropy; a film that reflects either clockwise or counterclockwise circular polarized light while transmitting other light, for example, a cholesteric liquid crystal layer, more specifically, an oriented film of a cholesteric liquid crystal polymer or an oriented liquid crystal layer supported on a supportive substrate, or the like.

~~[0043]~~

Therefore, with the brightness-enhanced film transmitting a linearly polarized light having a predetermined polarization axis, the transmitted light directly enters the polarizing plate with the polarization axes matched, so that absorption loss due to the polarizing plate is controlled and the light can be transmitted efficiently. On the other hand, with the brightness-enhanced film transmitting a circular polarized light, such as a cholesteric liquid crystal layer, ~~preferably,~~ the transmission circular polarized light is converted to linearly polarized light before entering the polarizing plate in an aspect of controlling of the absorption loss, though the circular polarized light can enter the polarizer directly. Circular polarized light can be converted to linearly polarized light by using a quarter wavelength plate as a retardation plate.

~~[0044]~~

A retardation plate having a function as a quarter wavelength plate in a wide wave range of a visible light region can be obtained, for example, by overlapping a

retardation layer functioning as a quarter wavelength plate for monochromatic light such as light having 550 nm wavelength and another retardation plate showing a separate optical retardation property, for example, a retardation plate functioning as a half wavelength plate. Therefore, a retardation plate arranged between a polarizing plate and a brightness-enhanced film can include a single layer or at least two layers of retardation layers.

~~[0045]~~

A cholesteric liquid crystal layer also can be provided by combining layers different in the reflection wavelength and it can be configured by overlapping two or at least three layers. As a result, the obtained retardation plate can reflect circular polarized light in a wide wavelength region of a visible light region, thus providing transmission circular polarized light in a wide wavelength region.

~~[0046]~~

Furthermore, a polarizing plate can be formed by laminating a polarizing plate and two or at least three optical layers like the above-mentioned polarization separating type polarizing plate. Therefore, the polarizing plate can be a reflective elliptical polarizing plate, a semitransparent elliptical polarizing plate or the like, which is prepared by combining the above-mentioned reflective polarizing plate or a semitransparent polarizing plate with a retardation plate. An optical member including a lamination of two or at least three optical layers can be formed in a method of laminating layers separately in a certain order for manufacturing a liquid crystal display etc. or in a method for preliminary lamination. Because an optical member that has been laminated previously has excellent stability in quality and assembling operability, efficiency in manufacturing a liquid crystal display can be improved. Any appropriate adhesion means such as a pressure sensitive adhesive layer can be used for lamination.

~~[0047]~~

The pressure sensitive adhesive layer can be provided on a polarizing plate or on an optical member for adhesion with other members such as a liquid crystal cell. The adhesive layer can be formed by the conventional appropriate pressure sensitive adhesives such as an acrylic pressure sensitive adhesive. Pressure sensitive adhesives having a low moisture absorption coefficient and an excellent heat resistance may be preferred from aspects of prevention of foaming or peeling caused by moisture absorption, prevention of decrease in the optical properties and warping of a liquid crystal cell caused by difference in thermal expansion coefficients, formation of a high quality liquid crystal display having excellent durability, etc. The pressure sensitive adhesive layer may contain fine particles to obtain optical diffusivity. Pressure sensitive adhesive layers can be provided on necessary surfaces if required. For example, the

polarizing plate including a polarizer and a protective layer can be provided with a pressure sensitive adhesive layer on at least one surface of the protective layer as required.

~~[0048]~~

When a pressure sensitive adhesive layer provided on the polarizing plate or the optical member is exposed on the surface, preferably, the pressure sensitive adhesive layer is temporarily covered with a separator for preventing contamination by the time the pressure sensitive adhesive layer is used. The separator can be made of an appropriate thin sheet by coating a peeling agent if required. Examples of a peeling agent include, for example, a silicone-based peeling agent, a long-chain alkyl-based peeling agent, a fluorine-based peeling agent, a peeling agent including molybdenum sulfide, or the like.

~~[0049]~~

The above-described members forming a polarizing plate and an optical member, such as a polarizing film, a transparent protective film, an optical layer, and a pressure sensitive adhesive layer can have ultraviolet absorption power by treating with an ultraviolet absorber such as, for example, an ester salicylate compound, a benzophenone compound, a benzotriazole compound, a cyanoacrylate compound, a nickel complex salt compound, and the like.

~~[0050]~~

The above-mentioned polarizing plate can~~preferably~~ be used for formation of various apparatus such as a liquid crystal display. The liquid crystal display can be produced as conventionally known structures, such as transmission type, reflection type, or a transmission-reflection type. A liquid crystal cell forming the liquid crystal display can be selected arbitrarily from appropriate cells such as active matrix driving type represented by a thin film transistor, a simple matrix driving type represented by a twist nematic type and a super twist nematic type.

~~[0051]~~

When polarizing plates or optical members are provided on both sides of a liquid crystal cell, the polarizing plates or the optical members on both sides can be the same or different. Moreover, for forming a liquid crystal display, one or at least two layers of appropriate members such as a prism array sheet, a lens array sheet, an optical diffuser, or a backlight can be arranged at appropriate positions.

~~[0052]~~

~~[Example]~~Example

Hereinafter, the present invention will be explained more specifically with reference to Examples and Comparative Examples.

~~[0053]~~

(Example 1)

Figure 1 is a cross-sectional view showing a polarizing plate according to Example 1 of the present invention. In Figure 1, an adhesive layer, which is usually used, is ~~omitted~~ not shown.

~~[0054]~~

TAC films 2 as protective layers having a thickness of 40 μm are attached to both surfaces of a polarizer 1 made of a 30 μm-thick PVA film containing iodine, while TAC films 3 as protective layers having a thickness of 40 μm are attached also to both sides of the polarizer 1. Thus, a polarizing plate was produced. The moisture permeability of this 40 μm-thick TAC film was 120 g/m^2□24h.

~~[0055]~~

(Example 2)

Figure 2 is a cross-sectional view showing a polarizing plate according to Example 2 of the present invention. In Figure 2, an adhesive layer, which is usually used, is omitted.

~~[0056]~~

TAC films 5 as protective layers having a thickness of 40 μm are attached to both surfaces of a polarizer 4 made of a 30 μm-thick PVA film containing iodine, while TAC resin 6 as protective layers having a thickness of 20 μm are coated on both sides of the polarizer 4. Thus, a polarizing plate was produced. The moisture permeability of this 20 μm-thick TAC resin was 0.59 g/m^2□24h.

~~[0057]~~

(Comparative Example 1)

A polarizing plate was prepared by the same method as in Example 1 except that protective films are not attached on both sides of the polarizer.

~~[0058]~~

(Comparative Example 2)

A polarizing plate was prepared by the same method as in Example 2 except that protective layers are not coated on both sides of the polarizer.

~~[0059]~~

(Humidity durability test)

After the polarizing plates produced in Examples 1 and 2 and Comparative Examples 1 and 2 were left at a temperature of 60°C and humidity of 95% for 100 hours, the rate of change in dimension of the polarizing plate in the longitudinal direction was measured. The rate of change in dimension was calculated from the following formula:

(dimension of polarizing plate in the longitudinal direction after left at humidity –

dimension of original polarizing plate in the longitudinal direction) / (dimension of original polarizing plate in the longitudinal direction) × 100.

~~[0060]~~

Next, the polarizing plates produced in Examples 1 and 2 and Comparative Examples 1 and 2 were attached to a plastic cell (100 mm × 100 mm) made of epoxy resin and left at a temperature of 60°C and humidity of 95% for 100 hours, and thereafter maximum values of warping amount at four corners of the cell were measured.

~~[0061]~~

Table 1 shows the results.

~~[0062]~~

~~[Table 1]~~Table 1

	rate of change in dimension (%)	maximum value of warping amount (mm)
Example 1	0.057	2.5
Example 2	0.017	2.2
Comparative Example 1	0.408	3.3
Comparative Example 2	0.253	3.1

~~[0063]~~

As is apparent from Table 1, in Examples 1 and 2, the rate of change in dimension is ±0.1% or less. On the other hand, in Comparative Examples 1 and 2, the rate of change in dimension is more than ±0.1%.

~~[0064]~~

Furthermore, in Examples 1 and 2, the warping amount is ± 3.0 mm or less. On the other hand, in Comparative Examples 1 and 2, the warping amount is more than ±3.0 mm.

~~[0065]~~

These results show that in the polarizing plate of the present invention, the change in dimension is small even if it is left at high humidity for a long time, and there are no problems in handling of a panel when the liquid crystal panel is equipped.

~~[0066]~~

~~[Effect of the invention]~~

As mentioned above, according to the present invention, all surfaces and sides of the polarizer are covered with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less, and thus it is possible to provide a polarizing plate having an excellent humidity durability and a liquid crystal display using such a polarizing plate.

~~[CLAIMS]~~ The invention may be embodied in other forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed in this application are to be considered in all respects as illustrative and not limitative. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

WHAT IS CLAIMED IS:

~~[Claim 1] A~~1. A polarizing plate comprising a polarizer, wherein all surfaces and sides of the polarizer are covered with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less.

~~[Claim 2] The~~2. The polarizing plate according to claim 1, wherein a rate of change in dimension of the polarizer in a uniaxially stretching direction is ±0.1% or less after the polarizer is left at a temperature of 60°C and humidity of 95% for 100 hours.

~~[Claim 3] The~~3. The polarizing plate according to claim 1 ~~or 2~~, wherein the polarizing plate is formed into a size of 90 mm×90 mm and attached to a plastic cell having a size of 100 mm×100 mm and a thickness of 400 μm, ~~and made~~the plastic cell comprising at least one selected from the group of a thermoplastic resin ~~or~~and a thermosetting resin, and when the cell is left at a temperature of 60°C and humidity of 95% for 100 hours, an amount of warping at each of four corners of the cell is ±3.0 mm or less.

~~[Claim 4] The~~4. The polarizing plate according to claim 3, wherein the thermoplastic resin comprises at least one selected from the group consisting of polycarbonate, polyalylate, polyether sulfone, polysulfone, polyester, polymethyl methacrylate, polyetherimide and polyamide.

~~polyamide; and~~5. The polarizing plate according to claim 3, wherein the thermosetting resin comprises at least one selected from the group consisting of epoxy resin, unsaturated polyester, polydiallyl phthalate and polyisobonyl methacrylate.

~~[Claim 5] The~~6. The polarizing plate according to ~~any of claims 1 to 4,~~claim 1, further comprising at least one selected from the group of a reflector ~~or~~and a transreflector attached to the polarizing plate.

~~[Claim 6] The~~7. The polarizing plate according to ~~any of claims 1 to 4,~~claim 1, further comprising at least one selected from the group of a retardation plate ~~or~~and a λ plate attached to the polarizing plate.

~~[Claim 7] The~~8. The polarizing plate according to ~~any of claims 1 to 4,~~claim 1, further comprising a viewing angle compensating film attached to the polarizing plate.

~~[Claim 8] The~~9. The polarizing plate according to ~~any of claims 1 to 4,~~claim 1, further comprising a brightness-enhanced film attached to the polarizing plate.

~~[Claim 9] A~~10. A liquid crystal display comprising: ~~on at least one side of a liquid crystal cell, a polarizer according to any claims 1 to 8.~~ a liquid crystal cell having a first side and a second side; and a polarizer having all surfaces and sides covered with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less; the polarizer attached to at least one side of the liquid crystal cell.

[Document name] Abstract

[Abstract]

11. The liquid crystal display according to claim 10, wherein a rate of change in dimension of the polarizer in a uniaxially stretching direction is ±0.1% or less after the polarizer is left at a temperature of 60°C and humidity of 95% for 100 hours.

12. The liquid crystal display according to claim 10, wherein the polarizing plate is formed into a size of 90 mm×90 mm and attached to a plastic cell having a size of 100 mm×100 mm and a thickness of 400 μm, the plastic cell comprising at least one selected from the group of a thermoplastic resin and a thermosetting resin, such that when the cell is left at a temperature of 60°C and humidity of 95% for 100 hours, an amount of warping at each of four corners of the cell is ±3.0 mm or less.

13. The liquid crystal display according to claim 12, wherein the thermoplastic resin comprises at least one selected from the group of polycarbonate, polyalylate, polyether sulfone, polysulfone, polyester, polymethyl methacrylate, polyetherimide and polyamide.

14. The liquid crystal display according to claim 12, wherein the thermosetting resin is at least one selected from the group of epoxy resin, unsaturated polyester, polydiallyl phthalate and polyisobonyl methacrylate.

15. The liquid crystal display according to claim 10, wherein at least one of a reflector and a transreflector is attached to the polarizing plate.

16. The liquid crystal display according to claim 10, wherein at least one of a retardation plate and a λ plate is attached to the polarizing plate.

17. The liquid crystal display according to claim 10, wherein a viewing angle compensating film is attached to the polarizing plate.

18. The liquid crystal display according to claim 10, wherein a brightness-enhanced film is attached to the polarizing plate.

ABSTRACT OF THE DISCLOSURE

~~[Problem] To provide a~~ A polarizing plate having excellent moisture durability and a liquid crystal display using the~~same.~~ ~~[Means for solving problem]~~same are disclosed. The polarizing plate is produced by covering all surfaces and sides of a polarizer with low moisture-permeable layers having moisture permeability of 310 g/m^2□24h or less. The rate of change in dimension of the polarizer in the uniaxially stretched direction is ±0.1% or less after left at a temperature of 60°C and humidity of 95% for 100 hours.

~~[Selected Drawings] Fig. 1~~

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【発明者】

【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内

【氏名】　杉野　洋一郎

【発明者】

【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内

【氏名】　濱本　英二

【発明者】

【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内

【氏名】　楠本　誠一

【発明者】

【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内

【氏名】　三原　尚史

【発明者】

【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内

【氏名】　吉川　せんり

【発明者】
　　【住所又は居所】　大阪府茨木市下穂積１丁目１番２号　日東電工株式会社内
　　【氏名】　土本　一喜
【特許出願人】
　　【識別番号】　000003964
　　【氏名又は名称】　日東電工株式会社
【代理人】
　　【識別番号】　100095555
　　【弁理士】
　　【氏名又は名称】　池内　寛幸
　　【電話番号】　06-6361-9334
【選任した代理人】
　　　【識別番号】　100076576
　　　【弁理士】
　　　【氏名又は名称】　佐藤　公博
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【発明の名称】　偏光板及びそれを用いた液晶表示装置

【特許請求の範囲】

【請求項１】　偏光子の全面を、透湿度３１０ｇ／m^2・２４ｈ以下の水分透過性の低い層で覆ったことを特徴とする偏光板。

【請求項２】　温度６０℃、湿度９５％で１００時間放置した後の前記偏光子の一軸延伸方向の寸法変化率が、±０．１％以下である請求項１に記載の偏光板。

【請求項３】　縦９０ｍｍ、横９０ｍｍの請求項１又は２に記載の偏光板を、縦１００ｍｍ、横１００ｍｍ、厚さ４００μｍの熱可塑性樹脂又は熱硬化性樹脂からなるプラスチックセルに貼り合わせた場合、温度６０℃、湿度９５％で１００時間放置した後の前記セルの四隅の反り量が、±３．０ｍｍ以下である偏光板。

【請求項４】　前記熱可塑性樹脂が、ポリカーボネート、ポリアリレート、ポリエーテルスルホン、ポリスルホン、ポリエステル、ポリメチルメタクリレート、ポリエーテルイミド及びポリアミドからなる群より選択された少なくとも１つであり、前記熱硬化性樹脂が、エポキシ系樹脂、不飽和ポリエステル、ポリジアリルフタレート及びポリイソボニルメタクリレートからなる群より選択された少なくとも１つである請求項３に記載の偏光板。

【請求項５】　反射板又は半透過反射板を貼り合わせた請求項１～４のいずれかに記載の偏光板。

【請求項６】　位相差板又はλ板を貼り合わせた請求項１～４のいずれかに記載の偏光板。

【請求項７】　視角補償フィルムを貼り合わせた請求項１～４のいずれかに記載の偏光板。

【請求項８】　輝度向上フィルムを貼り合わせた請求項１～４のいずれかに記載の偏光板。

【請求項９】　液晶セルの少なくとも片側に、請求項１～８のいずれかに記載の偏光板を使用した液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】

本発明は、液晶表示装置（以下、ＬＣＤと略称することがある。）に使用される偏光板及びそれを用いた液晶表示装置に関する。

【０００２】

【従来の技術】

ＬＣＤは、パソコン等に使用されており、近年、急激にその需要が増加している。ＬＣＤの用途は広がってきており、近年はモニター用途にも使用されるようになってきている。

【０００３】

ＬＣＤに使用する偏光板は、例えば、親水性高分子フィルムであるポリビニルアルコール（以下、ＰＶＡと略称することがある。）フィルムを、二色性を有するヨウ素又は二色性染料で染色する染色工程、ホウ酸やホウ砂等で架橋する架橋工程、及び一軸延伸する延伸工程の後に乾燥し、トリアセチルセルロース（以下、ＴＡＣと略称することがある。）フィルム等の保護層と貼り合わせて製造されている。なお、染色、架橋、延伸の各工程は、別々に行なう必要はなく同時に行なってもよく、また、各工程の順番も任意でよい。

【０００４】

【発明が解決しようとする課題】

ところで、偏光子を製膜後そのままの状態で使用すると取り扱い上の不具合や、水分の影響による劣化が起きるため、通常上記のとおり、その偏光子の両面に保護層となるトリアセチルセルロースフィルム等を貼り合わせて偏光板を形成している。

【０００５】

しかし、偏光板を液晶パネル用のサイズに切り出したとき、偏光子の両面にはトリアセチルセルロースフィルム等の保護層が形成されているが、切り出した偏光板の側面は親水性高分子フィルムから成る偏光子が剥き出しとなってしまう。従って、液晶表示装置に使用されている従来の偏光板は、高湿度の下に長時間放

置すると偏光子内の水分の変化により、寸法変化が大きくなり、液晶パネル装着時にパネル取り扱い上の不具合、また偏光機能の低下が起こるという問題があった。

【０００６】

そこで、本発明は、前記従来の問題を解決するため、加湿耐久性に優れた偏光板及びそれを用いた液晶表示装置を提供することを目的とする。

【０００７】

【課題を解決するための手段】

前記目的を達成するため本発明の偏光板は、偏光子の全面を、透湿度３１０ｇ／ｍ^2・２４ｈ以下の水分透過性の低い層で覆ったことを特徴とする。

【０００８】

本発明の偏光板は、温度６０℃、湿度９５％で１００時間放置した後の前記偏光子の一軸延伸方向の寸法変化率が、±０．１％以下であることが好ましい。

【０００９】

また、本発明の偏光板は、縦９０ｍｍ、横９０ｍｍの前記偏光板を、縦１００ｍｍ、横１００ｍｍ、厚さ４００μｍの熱可塑性樹脂又は熱硬化性樹脂からなるプラスチックセルに貼り合わせた場合、温度６０℃、湿度９５％で１００時間放置した後の前記セルの四隅の反り量が、±３．０ｍｍ以下であることが好ましい。

【００１０】

また、本発明の偏光板は、前記熱可塑性樹脂が、ポリカーボネート、ポリアリレート、ポリエーテルスルホン、ポリスルホン、ポリエステル、ポリメチルメタクリレート、ポリエーテルイミド及びポリアミドからなる群より選択された少なくとも１つであり、前記熱硬化性樹脂が、エポキシ系樹脂、不飽和ポリエステル、ポリジアリルフタレート及びポリイソボニルメタクリレートからなる群より選択された少なくとも１つであることが好ましい。

【００１１】

また、本発明の偏光板は、反射板又は半透過反射板を貼り合わせることが好ましい。

【００１２】

また、本発明の偏光板は、位相差板又はλ板を貼り合わせることが好ましい。

【００１３】

また、本発明の偏光板は、視角補償フィルムを貼り合わせることが好ましい。

【００１４】

また、本発明の偏光板は、輝度向上フィルムを貼り合わせることが好ましい。

【００１５】

次に、本発明の液晶表示装置は、液晶セルの少なくとも片側に、前記いずれかの偏光板を使用したことを特徴とする。

【００１６】

【発明の実施の形態】

本発明は、偏光子の全面に透湿度３１０ｇ／m^2・２４ｈ以下の水分透過性の低い層を設けることにより、高湿度の下で長時間放置されても偏光板の寸法変化が減少される。

【００１７】

偏光子の側面における水分透過性の低い層の設け方は、直接、透湿度３．９ｇ／m^2・２４ｈ以下の水分透過性の低い樹脂等を塗布する方法や透湿度３１０ｇ／m^2・２４ｈ以下の水分透過性の低いフィルムを貼り合せる方法がある。

【００１８】

また、ヨウ素染色、延伸により作製した偏光子を液晶パネル装着時のサイズに切りだし、そのフィルム全体に直接水分透過性の低い層を設けることによっても加湿耐久性に優れた偏光板を作製できる。

【００１９】

本発明で用いる偏光板の基本的な構成は、二色性物質含有のポリビニルアルコール系偏光フィルム等からなる偏光子の片側又は両側に、適宜の接着層、例えばビニルアルコール系ポリマー等からなる接着層を介して保護層となる透明保護フィルムを接着したものからなる。

【００２０】

偏光子（偏光フイルム）としては、例えばポリビニルアルコールや部分ホルマ

ール化ポリビニルアルコールなどの従来に準じた適宜なビニルアルコール系ポリマーよりなるフィルムにヨウ素や二色性染料等よりなる二色性物質による染色処理や延伸処理や架橋処理等の適宜な処理を適宜な順序や方式で施してなり、自然光を入射させると直線偏光を透過する適宜なものを用いうる。特に、光透過率や偏光度に優れるものが好ましい。

【００２１】

偏光子（偏光フィルム）の片側又は両側に設ける透明保護層となる保護フィルム素材としては、適宜な透明フィルムを用いうる。そのポリマーの例としてトリアセチルセルロースの如きアセテート系樹脂が一般的に用いられるが、これに限定されるものではない。

【００２２】

偏光特性や耐久性などの点より、特に好ましく用いうる透明保護フィルムは、表面をアルカリなどでケン化処理したトリアセチルセルロースフィルムである。なお、偏光フィルムの両側に透明保護フィルムを設ける場合、その表裏で異なるポリマー等からなる透明保護フィルムを用いてもよい。

【００２３】

保護層に用いられる透明保護フイルムは、本発明の目的を損なわない限り、ハードコート処理や反射防止処理、スティッキングの防止や拡散ないしアンチグレア等を目的とした処理などを施したものであってもよい。ハードコート処理は、偏光板表面の傷付き防止などを目的に施されるものであり、例えばシリコーン系などの適宜な紫外線硬化型樹脂による硬度や滑り性等に優れる硬化被膜を透明保護フィルムの表面に付加する方式などにて形成することができる。

【００２４】

一方、反射防止処理は偏光板表面での外光の反射防止を目的に施されるものであり、従来に準じた反射防止膜などの形成により達成することができる。また、スティッキング防止は隣接層との密着防止を目的に、アンチグレア処理は偏光板の表面で外光が反射して偏光板透過光の視認を阻害することの防止などを目的に施されるものであり、例えばサンドブラスト方式やエンボス加工方式等による粗面化方式や透明微粒子の配合方式などの適宜な方式にて透明保護フィルムの表面

に微細凹凸構造を付与することにより形成することができる。

【００２５】

前記の透明微粒子には、例えば平均粒径が０．５～２０μｍのシリカやアルミナ、チタニアやジルコニア、酸化錫や酸化インジウム、酸化カドミウムや酸化アンチモン等が挙げられ、導電性を有する無機系微粒子を用いてもよく、また、架橋又は未架橋のポリマー粒状物等からなる有機系微粒子などを用いうる。透明微粒子の使用量は、透明樹脂１００質量部あたり２～７０質量部、とくに５～５０質量部が一般的である。

【００２６】

透明微粒子配合のアンチグレア層は、透明保護層そのものとして、あるいは透明保護層表面への塗工層などとして設けることができる。アンチグレア層は、偏光板透過光を拡散して視角を拡大するための拡散層（視角補償機能など）を兼ねるものであってもよい。なお、上記した反射防止層やスティッキング防止層、拡散層やアンチグレア層等は、それらの層を設けたシートなどからなる光学層として透明保護層とは別体のものとして設けることもできる。

【００２７】

前記偏光子（偏光フィルム）と保護層である透明保護フィルムとの接着処理は、特に限定されるものではないが、例えば、ビニルアルコール系ポリマーからなる接着剤、あるいは、ホウ酸やホウ砂、グルタルアルデヒドやメラミン、シュウ酸などのビニルアルコール系ポリマーの水溶性架橋剤から少なくともなる接着剤などを介して行なうことができる。かかる接着層は、水溶液の塗布乾燥層などとして形成しうるが、その水溶液の調製に際しては必要に応じて、他の添加剤や、酸等の触媒も配合することができる。

【００２８】

偏光板は、実用に際して他の光学層と積層した光学部材として用いることができる。その光学層については特に限定はないが、例えば反射板や半透過反射板、位相差板（１／２波長板、１／４波長板などのλ板も含む）、視角補償フィルムや輝度向上フィルムなどの、液晶表示装置等の形成に用いられことのある適宜な光学層の１層又は２層以上を用いることができ、特に、前述した本発明の偏光子

と保護層からなる偏光板に、更に反射板または、半透過反射板が積層されてなる反射型偏光板または半透過反射板型偏光板、前述した偏光子と保護層からなる偏光板に、更に位相差板が積層されている楕円偏光板または円偏光板、前述した偏光子と保護層からなる偏光板に、更に視角補償フィルムが積層されている偏光板、あるいは、前述した偏光子と保護層からなる偏光板に、更に輝度向上フィルムが積層されている偏光板が好ましい。

【００２９】

前記の反射板について説明すると、反射板は、それを偏光板に設けて反射型偏光板を形成するためのものであり、反射型偏光板は、通常液晶セルの裏側に設けられ、視認側（表示側）からの入射光を反射させて表示するタイプの液晶表示装置などを形成でき、バックライト等の光源の内蔵を省略できて液晶表示装置の薄型化を図りやすいなどの利点を有する。

【００３０】

反射型偏光板の形成は、必要に応じ上記した透明保護フィルム等を介して偏光板の片面に金属等からなる反射層を付設する方式などの適宜な方式にて行なうことができる。その具体例としては、必要に応じマット処理した透明保護フィルムの片面に、アルミニウム等の反射性金属からなる箔や蒸着膜を付設して反射層を形成したものなどが挙げられる。

【００３１】

また、微粒子を含有させて表面を微細凹凸構造とした上記の透明保護フィルムの上に、その微細凹凸構造を反映させた反射層を有する反射型偏光板なども挙げられる。表面微細凹凸構造の反射層は、入射光を乱反射により拡散させて指向性やギラギラした見栄えを防止し、明暗のムラを抑制しうる利点などを有する。透明保護フィルムの表面微細凹凸構造を反映させた微細凹凸構造の反射層の形成は、例えば真空蒸着方式、イオンプレーティング方式、スパッタリング方式等の蒸着方式やメッキ方式などの適宜な方式で金属を透明保護フィルムの表面に直接付設する方法などにより行なうことができる。

【００３２】

また、反射板は、上記した偏光板の透明保護フィルムに直接付設する方式に代

えて、その透明保護フィルムに準じた適宜なフィルムに反射層を設けてなる反射シートなどとして用いることもできる。反射板の反射層は、通常、金属からなるので、その反射面がフィルムや偏光板等で被覆された状態の使用形態が、酸化による反射率の低下防止、ひいては初期反射率の長期持続の点や、保護層の別途付設の回避の点などから好ましい。

【００３３】

なお、半透過型偏光板は、上記において反射層で光を反射し、かつ透過するハーフミラー等の半透過型の反射層とすることにより得ることができる。半透過型偏光板は、通常液晶セルの裏側に設けられ、液晶表示装置などを比較的明るい雰囲気で使用する場合には、視認側（表示側）からの入射光を反射させて画像を表示し、比較的暗い雰囲気においては、半透過型偏光板のバックサイドに内蔵されているバックライト等の内蔵光源を使用して画像を表示するタイプの液晶表示装置などを形成できる。すなわち、半透過型偏光板は、明るい雰囲気下では、バックライト等の光源使用のエネルギーを節約でき、比較的暗い雰囲気下においても内蔵光源を用して使用できるタイプの液晶表示装置などの形成に有用である。

【００３４】

次に、前述した偏光子と保護層からなる偏光板に、更に位相差板が積層されている楕円偏光板または円偏光板について説明する。

【００３５】

直線偏光を楕円偏光または円偏光に変えたり、楕円偏光または円偏光を直線偏光に変えたり、あるいは直線偏光の偏光方向を変える場合に、位相差板などが用いられ、特に、直線偏光を楕円偏光または円偏光に変えたり、楕円偏光または円偏光を直線偏光に変える位相差板としては、いわゆる１／４波長板（λ／４板とも言う）が用いられる。１／２波長板（λ／２板とも言う）は、通常、直線偏光の偏光方向を変える場合に用いられる。

【００３６】

楕円偏光板は、スーパーツイストネマチック（ＳＴＮ）型液晶表示装置の液晶層の複屈折によって生じた着色（青又は黄）を補償（防止）して、前記着色のない白黒表示にする場合などに有効に用いられる。更に、３次元の屈折率を制御し

たものは、液晶表示装置の画面を斜め方向 から見た際に生じる着色も補償（防止）することができ好ましい。円偏光板は、例えば画像がカラー表示になる反射型液晶表示装置の画像の色調を整える場合などに有効に用いられ、また、反射防止の機能も有する。

【００３７】

前記位相差板の具体例としては、ポリカーボネートやポリビニルアルコール、ポリスチレンやポリメチルメタクリレート、ポリプロピレンやその他のポリオレフィン、ポリアリレートやポリアミドの如き適宜なポリマーからなるフィルムを延伸処理してなる複屈折性フィルムや液晶ポリマーの配向フィルム、液晶ポリマーの配向層をフィルムにて支持したものなどが挙げられる。また、傾斜配向フィルムとしては、例えばポリマーフィルムに熱収縮性フィルムを接着して加熱によるその収縮力の作用下にポリマーフィルムを延伸処理又は／及び収縮処理したものや液晶ポリマーを斜め配向させたものなどが挙げられる。

【００３８】

次に、前述した偏光子と保護層からなる偏光板に、更に視角補償フィルムが積層されている偏光板について説明する。

【００３９】

視角補償フィルムは、液晶表示装置の画面を、画面に垂直でなくやや斜めの方向から見た場合でも、画像が比較的鮮明に見えるように視角を広げるためのフィルムである。

【００４０】

このような視角補償フィルムとしては、トリアセチルセルロースフィルムなどにディスコティック液晶を塗工したものや、位相差板が用いられる。通常の位相差板には、その面方向に一軸に延伸された複屈折を有するポリマーフィルムが用いられるのに対し、視角補償フィルムとして用いられる位相差板には、面方向に二軸に延伸された複屈折を有するポリマーフィルムとか、面方向に一軸に延伸され厚さ方向にも延伸された厚さ方向の屈折率を制御した傾斜配向ポリマーフィルムのような２方向延伸フィルムなどが用いられる。傾斜配向フィルムとしては、前述したように、例えばポリマーフィルムに熱収縮性フィルムを接着して加熱に

よるその収縮力の作用下にポリマーフィルムを延伸処理又は／及び収縮処理したものや、液晶ポリマーを斜め配向させたものなどが挙げられる。位相差板の素材原料ポリマーは、先の位相差板で説明したポリマーと同様のものが用いられる。

【００４１】

前述した偏光子と保護層からなる偏光板に、輝度向上フィルムを貼り合わせた偏光板は、通常液晶セルの裏側サイドに設けられて使用される。輝度向上フィルムは、液晶表示装置などのバックライトや裏側からの反射などにより自然光が入射すると所定偏光軸の直線偏光又は所定方向の円偏光を反射し、他の光は透過する特性を示すもので、輝度向上フィルムを前述した偏光子と保護層とからなる偏光板と積層した偏光板は、バックライト等の光源からの光を入射させて所定偏光状態の透過光を得ると共に、前記所定偏光状態以外の光は透過せずに反射される。この輝度向上フィルム面で反射した光を更にその後ろ側に設けられた反射層等を介し反転させて輝度向上板に再入射させ、その一部又は全部を所定偏光状態の光として透過させて輝度向上フイルムを透過する光の増量を図ると共に、偏光子に吸収されにくい偏光を供給して液晶画像表示等に利用しうる光量の増大を図ることにより輝度を向上させうるものである。すなわち、輝度向上フィルムを使用せずに、バックライトなどで液晶セルの裏側から偏光子を通して光を入射した場合には、偏光子の偏光軸に一致していない偏光方向を有する光はほとんど偏光子に吸収されてしまい、偏光子を透過してこない。すなわち、用いた偏光子の特性によっても異なるが、およそ５０％の光が偏光子に吸収されてしまい、その分、液晶画像表示等に利用しうる光量が減少し、画像が暗くなる。輝度向上フィルムは、偏光子に吸収されるような偏光方向を有する光を偏光子に入射させずに輝度向上フィルムで一旦反射させ、更にその後ろ側に設けられた反射層等を介して反転させて輝度向上板に再入射させることを繰り返し、この両者間で反射、反転している光の偏光方向が偏光子を通過し得るような偏光方向になった偏光のみを、輝度向上フィルムは透過させて偏光子に供給するので、バックライトなどの光を効率的に液晶表示装置の画像の表示に使用でき、画面を明るくすることができるのである。

【００４２】

前記の輝度向上フィルムとしては、例えば誘電体の多層薄膜や屈折率異方性が相違する薄膜フィルムの多層積層体の如き、所定偏光軸の直線偏光を透過して他の光は反射する特性を示すもの、コレステリック液晶層、特にコレステリック液晶ポリマーの配向フィルムやその配向液晶層をフィルム基材上に支持したものの如き、左回り又は右回りのいずれか一方の円偏光を反射して他の光は透過する特性を示すものなどの適宜なものを用いうる。

【００４３】

従って、前記した所定偏光軸の直線偏光を透過するタイプの輝度向上フィルムでは、その透過光をそのまま偏光板に偏光軸を揃えて入射させることにより、偏光板による吸収ロスを抑制しつつ効率よく透過させることができる。一方、コレステリック液晶層の如く円偏光を透過するタイプの輝度向上フィルムでは、そのまま偏光子に入射させることもできるが、吸収ロスを抑制する点よりその透過円偏光を位相差板を介し直線偏光化して偏光板に入射させることが好ましい。なお、その位相差板として１／４波長板を用いることにより、円偏光を直線偏光に変換することができる。

【００４４】

可視光域等の広い波長範囲で１／４波長板として機能する位相差板は、例えば波長５５０ｎｍの光等の単色光に対して１／４波長板として機能する位相差層と他の位相差特性を示す位相差層、例えば１／２波長板として機能する位相差層とを重畳する方式などにより得ることができる。従って、偏光板と輝度向上フィルムの間に配置する位相差板は、１層又は２層以上の位相差層からなるものであってよい。

【００４５】

なお、コレステリック液晶層についても、反射波長が相違するものの組合せにして２層又は３層以上重畳した配置構造とすることにより、可視光域等の広い波長範囲で円偏光を反射するものを得ることができ、それに基づいて広い波長範囲の透過円偏光を得ることができる。

【００４６】

また、偏光板は、上記した偏光分離型偏光板の如く、偏光板と２層又は３層以

上の光学層とを積層したものからなっていてもよい。従って、上記の反射型偏光板や半透過型偏光板と位相差板を組合せた反射型楕円偏光板や半透過型楕円偏光板などであってもよい。２層又は３層以上の光学層を積層した光学部材は、液晶表示装置等の製造過程で順次別個に積層する方式にても形成しうるものであるが、予め積層して光学部材としたものは、品質の安定性や組立作業性等に優れて液晶表示装置などの製造効率を向上させうる利点がある。なお、積層には、粘着層等の適宜な接着手段を用いうる。

【００４７】

前述した偏光板や光学部材には、液晶セル等の他部材と接着するための粘着層を設けることもできる。その粘着層は、アクリル系等の従来に準じた適宜な粘着剤にて形成することができる。特に、吸湿による発泡現象や剥がれ現象の防止、熱膨張差等による光学特性の低下や液晶セルの反り防止、ひいては高品質で耐久性に優れる液晶表示装置の形成性などの点より、吸湿率が低くて耐熱性に優れる粘着層であることが好ましい。また、微粒子を含有して光拡散性を示す粘着層などとすることもできる。粘着層は必要に応じて必要な面に設ければよく、例えば、偏光子と保護層からなる偏光板の保護層について言及するならば、必要に応じて、保護層の片面又は両面に粘着層を設ければよい。

【００４８】

偏光板や光学部材に設けた粘着層が表面に露出する場合には、その粘着層を実用に供するまでの間、汚染防止等を目的にセパレータにて仮着カバーすることが好ましい。セパレータは、上記の透明保護フィルム等に準じた適宜な薄葉体に、必要に応じシリコーン系や長鎖アルキル系、フッ素系や硫化モリブデン等の適宜な剥離剤による剥離コートを設ける方式などにより形成することができる。

【００４９】

なお、上記の偏光板や光学部材を形成する偏光フィルムや透明保護フィルム、光学層や粘着層などの各層は、例えばサリチル酸エステル系化合物やベンゾフェノン系化合物、ベンゾトリアゾール系化合物やシアノアクリレート系化合物、ニッケル錯塩系化合物等の紫外線吸収剤で処理する方式などの適宜な方式により紫外線吸収能を持たせたものなどであってもよい。

【００５０】

前記偏光板は、液晶表示装置等の各種装置の形成などに好ましく用いることができる。液晶表示装置は、偏光板を液晶セルの片側又は両側に配置してなる透過型や反射型、あるいは透過・反射両用型等の従来に準じた適宜な構造を有するものとして形成することができる。従って、液晶表示装置を形成する液晶セルは任意であり、例えば薄膜トランジスタ型に代表されるアクティブマトリクス駆動型のもの、ツイストネマチック型やスーパーツイストネマチック型に代表される単純マトリクス駆動型のものなどの適宜なタイプの液晶セルを用いたものであってよい。

【００５１】

また、液晶セルの両側に偏光板や光学部材を設ける場合、それらは同じものであってもよいし、異なるものであってもよい。さらに、液晶表示装置の形成に際しては、例えばプリズムアレイシートやレンズアレイシート、光拡散板やバックライトなどの適宜な部品を適宜な位置に１層又は２層以上配置することができる。

【００５２】

【実施例】

以下、実施例及び比較例を用いて本発明を更に具体的に説明する。

【００５３】

（実施例１）

図１は、本発明の実施例１の偏光板の断面図である。なお、図１では、通常用いられる接着層は省略してある。

【００５４】

ヨウ素を含有させた厚さ３０μｍのＰＶＡフィルムからなる偏光子１の両平面に厚さ４０μｍのＴＡＣフィルム２を保護フィルムとして貼り合わせると共に、その偏光子１の両側面にも同様に厚さ４０μｍのＴＡＣフィルム３を保護フィルムとして貼り合わせて偏光板を形成した。この４０μｍのＴＡＣフィルムの透湿性は、１２０ｇ／m^2・２４ｈであった。

【００５５】

（実施例２）

図２は、本発明の実施例２の偏光板の断面図である。なお、図２では、通常用いられる接着層は省略してある。

【００５６】

ヨウ素を含有させた厚さ３０μｍのＰＶＡフィルムからなる偏光子４の両平面に厚さ４０μｍのＴＡＣフィルム５を保護フィルムとして貼り合わせると共に、その偏光子４の両側面に厚さ２０μｍのＴＡＣ樹脂６を保護層として塗布して偏光板を形成した。この２０μｍのＴＡＣ樹脂の透湿性は、０．５９ｇ／m^2・２４ｈであった。

【００５７】

（比較例１）

偏光子の両側面に保護フィルムを貼り合わせていないこと以外は、実施例１と同様にして偏光板を形成した。

【００５８】

（比較例２）

偏光子の両側面に保護層を塗布していないこと以外は、実施例２と同様にして偏光板を形成した。

【００５９】

（加湿耐久性試験）

実施例１、実施例２、比較例１及び比較例２で形成した偏光板を温度６０℃、湿度９５％で１００時間放置した後の長さ方向の寸法変化率を測定した。寸法変化率は、（放置後の偏光板の長さ方向の寸法－元の偏光板の長さ方向の寸法）／（元の偏光板の長さ方向の寸法）×１００で求めた。

【００６０】

次に、実施例１、実施例２、比較例１及び比較例２で形成した偏光板を縦１００ｍｍ、横１００ｍｍのエポキシ系樹脂からなるプラスチックセルに貼り合わせ、温度６０℃、湿度９５％で１００時間放置した後の前記セルの四隅の反り量の最大値を測定した。

【００６１】

以上の結果を表１に示す。

【００６２】

【表１】

	寸法変化率 (%)	反り量の最大値 (mm)
実施例1	0.057	2.5
実施例2	0.017	2.2
比較例1	0.408	3.3
比較例2	0.253	3.1

【００６３】

表１から明らかなように、実施例１及び実施例２の寸法変化率は、いずれも±０．１％以下であるのに対し、比較例１及び比較例２では、いずれもそれを超えている。

【００６４】

また、実施例１及び実施例２の反り量は、いずれも±３．０ｍｍ以下であるのに対し、比較例１及び比較例２では、いずれもそれを超えている。

【００６５】

これらの結果より、本発明の偏光板は、高湿度の下に長時間放置しても寸法変化が小さく、液晶パネル装着時のパネル取り扱い上の不具合もないことが分かる。

【００６６】

【発明の効果】

以上のように本発明は、偏光子の全面を、透湿度３１０ｇ／m^2・２４ｈ以下の水分透過性の低い層で覆うことにより、加湿耐久性に優れた偏光板及びそれを用いた液晶表示装置を提供でき、その工業的価値は大である。

【図面の簡単な説明】

【図１】本発明の実施例１の偏光板の断面図である。

【図２】本発明の実施例２の偏光板の断面図である。

【符号の説明】

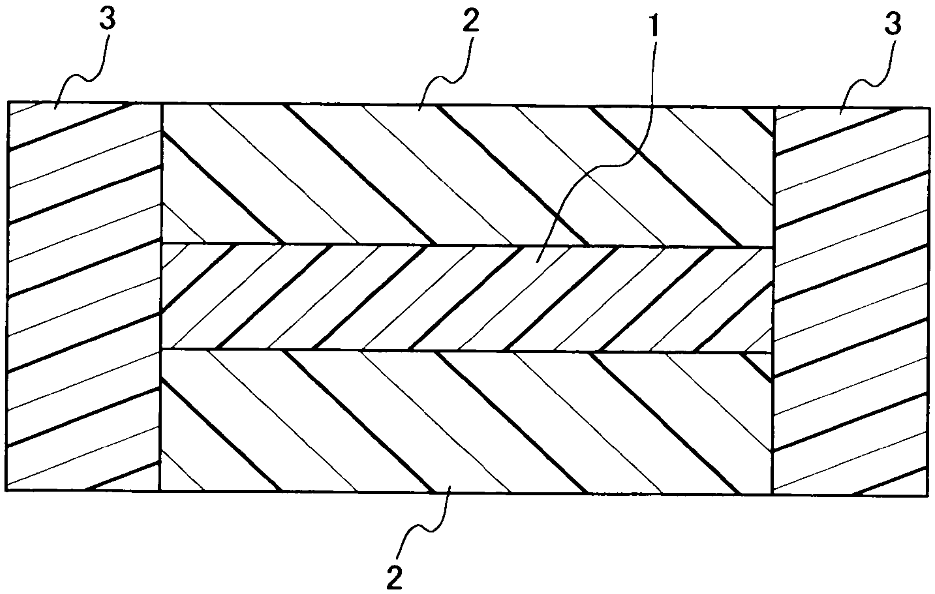
１、４　　　偏光子

２、３、５　ＴＡＣフィルム

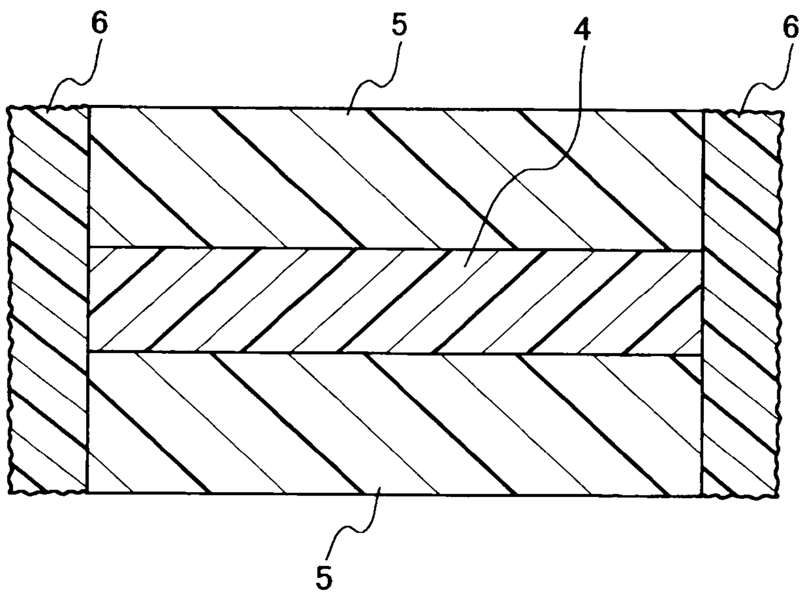
６　　　　　ＴＡＣ樹脂

【書類名】　図面

【図１】



【図２】



【書類名】　要約書

【要約】

【課題】加湿耐久性に優れた偏光板及びそれを用いた液晶表示装置を提供する。

【解決手段】偏光子の全面を、透湿度３１０ｇ／m^2・２４ｈ以下の水分透過性の低い層で覆い、温度６０℃、湿度９５％で１００時間放置した後の前記偏光子の一軸延伸方向の寸法変化率が、±０．１％以下である偏光板とする。

【選択図】　図１

出　願　人　履　歴　情　報

識別番号　　　　［０００００３９６４］

１．変更年月日　　１９９０年　８月３１日
　［変更理由］　　新規登録
　　住　所　　　大阪府茨木市下穂積１丁目１番２号
　　氏　名　　　日東電工株式会社

２．変更年月日　　２００３年　５月１３日
　［変更理由］　　名称変更
　　　　　　　　住所変更
　　住　所　　　大阪府茨木市下穂積１丁目１番２号
　　氏　名　　　日東電工株式会社